VARIABLE DYNAMIC TESTBED VEHICLE DYNAMICS ANALYSIS

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Abstract

The Variable Dynamic Testbed Vehicle (V1)TV) is a vehicle that is equipped with several actively controlled subsystems, and is capable of emulating a broad range of automobile dynamic characteristics. It has been proposed as a tool to evaluate collision avoidance systems and to perform driving-related human factors research, among other applications. The goal of this study is to analytically investigate to what extent a VDTV with adjustable front and rear anti-roll bar stiffnesses, programmable damping rates, and four- wheel- steering can emulate the lateral dynamics of a broad range of passenger vehicles. Using a selected compact-sized automobile as a baseline, our study indicated this baseline vehicle can be controlled to emulate the lateral response characteristics (including the vehicle's understeer coefficient and the 90% lateral acceleration rise time in a J-turn maneuver) of a fled of production vehicles, from low to high lateral acceleration conditions. Also, the roll gradient of the baselined vehicle can be altered via changes made to the torsional stiffnesses of the front and/or rear anti-roll bars to emulate the roll stiffnesses of a fled of production vehicles.

Key Words: Anti-roll bar, Emulation, Four-wheel-steering, Lateral response characteristics, Simulation, Variable Dynamic Vehicle.